RANGELAND INVENTORY & MONITORING

SUPPLEMENTAL STUDIES
—ADDITION—

TRANSMITTAL SHEET

Addendum to Technical Reference 4400-5 dated September 1992

Filing Instructions:

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INTRODUCTION

This Technical Reference contains the rangeland inventory and monitoring techniques historically used in the Bureau since the formation of the Grazing Service. It does not include local or regional techniques. Where manuals could not be located, the best available documentation was used.

Every effort has been made to accurately transcribe the original manuals. Editing was limited to the introductory Editor's Notes in Sections I - XII and XVII - XIX to preserve the original wording intact. However, Sections XIII - XVI were rewritten for clarity, since there was no need to be concerned about preserving an original manuscript.

This technical reference is designed to be a reference document. It is not intended as an endorsement of these methods as Bureau-approved procedures.

Many existing case files (allotment and operator files) and district files contain resource information gathered using procedures that are no longer approved methods. Some of this data is still being used to determine the grazing preference on public land and the carrying capacity on nonfederal lands. The procedures employed by some of these methods are now obscure. Since this resource information is still being used, this document will help to explain how the data was collected. It also provides instructions on how to collect data for future comparison.

Historical inventory and monitoring data are often useful for making long-term analyses of trends and ecological change. Although some historical techniques may be considered to be technically inadequate, the data may still be useful in making general interpretations. Knowledge of the intent or purpose of historical methods aids in understanding why previous range managers managed the range the way they did, and in determining if certain reports, e.g., range condition, can be compared to the concepts and reports used today.

It is very important for future reference that any old monitoring and inventory data not be disposed of.

If a description in this document does not accurately portray a historical technique, comments and supporting documentation should be sent to the National Applied Resource Sciences Center (RS-140).

XVII. PHOTO PLOT METHOD

Editor's Note: The Photo Plot Method procedures were transcribed from the original text in BLM Technical Reference 4400-4, Rangeland Monitoring - Trend Studies, dated May 1985.

A. General Description

The Photo Plot Method includes taking a close-up photograph of either a 3- x 3-foot plot or a 5- x 5-foot plot and a general-view photograph of the study site. In addition, measurements and/or estimates are made to provide quantitative data concerning vegetation characteristics that may or may not be seen in the photographs. The following indicators of trend are monitored with this method:

1. Foliar and basal cover (including litter)
2. Composition (by cover)
3. Reproduction of key species
4. Density

B. Areas of Use

This method has wide applicability and is suited for use with grasses, forbs, and shrubs.

C. Advantages and Limitations

This method provides both a photographic record and a measurement or estimate of the vegetation cover and composition. Depending on the density of the vegetation, it may take considerable time to measure and estimate the vegetation on the plot. Limitations of this method are the extremely small area sampled, the difficulty in identifying seedlings, and the variation in the data collected among examiners.

D. Equipment

1. Study Location and Documentation Data form (see Illustration 59)
2. Trend Study Data - Photo Plot Method form (see Illustration 60)
3. Photo Identification Label (see Illustration 61)
4. Frame to delineate the 3- x 3-foot or 5- x 5-foot plots (see Illustrations 62 and 63)
5. Square-foot gridded frame with 16 equal divisions (see Illustration 62)
6. Stakes: 3/4- or 1-inch angle iron not less than 16 inches long
7. Hammer
8. Permanent yellow or orange spray paint
9. Camera: 35-mm with a 28-mm wide-angle lens
10. Exposure meter (if camera is not equipped with one)

11. Film
12. Tripod (optional)
13. Small step ladder (for 5- x 5-foot photo plots)
14. Black felt-tip pen
15. Measuring tape calibrated in tenths of inches
16. Steel post
17. Post driver
18. Compass

E. Training

Examiners must be able to identify plant species. They must know how measurements and estimates on the plots are collected and recorded. The accuracy of the data depends on how well examiners are trained and on their ability to measure or estimate cover.

F. Establishing Plots

Careful establishment of plots is a critical element in obtaining meaningful data.

1. Site Selection

Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number, size, and location of the plots.

2. Number of Plots

Establish one plot on each key area; establish more if needed.

3. Plot Size and Shape

Use a 3- x 3-foot plot in herbaceous vegetation and a 5- x 5-foot plot in shrub vegetation. If the herbaceous vegetation is sparse, the 5- x 5-foot plot may be used.

a. ***Plot Frame - 3- x 3-foot.*** Rods are used to divide the 3-x 3-foot frame into nine equal square-foot sections. A square-foot frame gridded into 16 equal units can be used to obtain more precise data. Each of these grid units represents 0.7 percent of the area of a 3- x 3-foot plot (see Illustration 62).

b. ***Plot Frame - 5- x 5-foot.*** The 5- x 5-foot frame is supported above the vegetation by six telescoping legs. A gridded overlay frame, 1 foot wide and 5 feet long, divides the plot frame into smaller units. The overlay frame is constructed of welding rod and is gridded into 1/16-square-foot units. The plot frame is marked at 1-foot intervals on two parallel sides so that the gridded overlay frame can be positioned at 1-foot intervals across the plot (see Illustration 63).

4. Plot Location

a. Permanently mark plots with angle-iron stakes driven into the ground at two diagonal corners of the plots (see Illustration 64).

b. Paint the stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent readings are made.

5. Reference Post or Point

Permanently mark the location of each plot by means of a reference post (steel post) placed about 100 feet from the plot. Record the bearing and distance from the post to the plot. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the plot. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

6. Plot Identification

Number plots for proper identification to ensure that the data collected can be positively associated with specific sites on the ground (see Illustration 65).

7. Plot Documentation

Document the location, size, and other pertinent information concerning the plot on the Study Location and Documentation Data Form (see Illustration 59). Plot the precise location of the photo plots on detailed maps and/or aerial photos.

G. Taking Photographs

Take close-up photographs of the plot, as well as the general-view photographs, before making any measurements or estimates.

H. Sampling Process

Count seedlings and mature plants by species and determine vegetation cover and composition by measurement and/or estimation. Record the data on the Trend Study Data - Photo Plot Method form (see Illustration 60). When repeat measurements or estimates are made, follow the same process used in making the initial measurements or estimates. In addition to collecting the specific studies data, general observations should be made of the study sites.

1. Number of Plants

Count and record on the form the number of seedlings and mature perennial plants, by species, within the plot. In dense vegetation, the plants may be counted on a randomly selected small portion of the plot and converted to the total for the plot. The form

includes space for a plot diagram where the examiner can sketch in all the plants or just the key species.

2. Measuring Cover

Record basal and foliar cover in square inches on the form. Measurements are made where the growth form is a bunch type and clearly defined, such as occurs with bluebunch wheatgrass (Agropyron spicatum) or Indian ricegrass (Oryzopsis hymenoides). Measure vegetation in its natural state, not "bunched" or "compressed" (see Illustration 66). Most plant species grow in the form of an ellipse rather than a circle. Therefore, basal area measurements of bunchgrass and foliar cover measurements of forbs and shrubs will consist of two measurements—the long and short diameters. Area is calculated by using the formula, Area = πab, where a and b are lengths of major and minor radii. (Radii are obtained by taking half of the measured diameters.)

a. ***Grasses.*** Measure basal area of bunchgrasses to the nearest 1/10 inch at 1 inch above the soil surface. Measure any dead or vacant central portions of a grass clump and subtract this from the total if the portion is larger than 10 percent of the plant basal area.

b. ***Forbs and Shrubs.*** Measure foliar cover of forbs and shrubs, projected to the ground surface as viewed from directly above, if they are clearcut in outline. Subtract dead or vacant central portions exceeding 10 percent of the plant cover. For example, a shrub measures 14 x 20 inches but an area in the center, 5 x 8 inches, is "open." The area of the shrub is:

$A = \pi ab - \pi a'b' = (3.14)(7)(10)-(3.14)(2.5)(4) = 188$ square inches.

3. Estimating Cover

Estimates are made on litter and plants that are difficult to measure, i.e., creeping or decumbent forms. Estimations are more rapid than measurements but not as sensitive because small changes in plant size may not be readily detected.

a. ***Making Estimates Using the 3- x 3-foot Plot.*** Place the square-foot gridded frame over each square foot of the plot (see Illustration 62). Observe the vegetation cover from directly above the grid and count the number of 1/16-square-foot units of basal or foliar cover by species. Do this for each species on the plot. Record the number of units of basal or foliar cover by species on the form. If the observed cover does not fill any specific 1/16-square-foot unit, estimate the percent of a unit that is filled. Estimate the amount of litter cover in the same manner.

b. ***Making Estimates Using the 5- x 5-foot Plot.*** Place the 1- x 5-foot gridded frame over a 1- x 5-foot section of the plot frame (see Illustration 63). Observe the vegetation cover and count the number of 1/16-square-foot units of basal or foliar cover by species in the same manner as described for making estimates using the 3- x 3-foot plot (see preceding section). Advance the gridded frame a foot at a time until the

plot has been covered. Litter cover and cover by understory species can be estimated with the 1-square-foot gridded frame if desired.

c. ***Estimating Cover of Stoloniferous Grasses.*** Generally, the cover for stoloniferous grasses can be estimated because they form a dense closed sod cover. Determine basal ground cover, as viewed through the 1/16-square-foot units of the grid.

d. ***Estimating Cover of Forbs and Shrubs.*** Record the foliar cover of forbs and shrubs as viewed through the small grids. Do not count grids filled with dead portions of the plants.

4. Combining Measurements and Estimates

Measurements and estimates are used if both clearly defined and irregularly shaped plants occur in a plot. For example, a plot contains a very irregular-shaped shrub, two or three bunchgrasses, and a thin cover of rhizomatous grasses. Estimate the foliar cover of the shrub and the basal area of the rhizomatous grasses, but measure the basal area of the bunchgrasses.

a. ***Rhizomatous Grasses.*** Rhizomatous grasses are difficult to measure or estimate. Where only a few stems are present, count and record the number. Where the entire plot contains widely spaced stems, count the stems in randomly selected grids and then convert this to a total number for the plot. Count stems in at least 10 percent of the grids that contain the species. Convert these to basal area. Measure the area of 15 to 20 stems (or some other unit) and multiply by the total number. [Editor's note: To make calculations easy, measure the number of stems in one square inch and then divide the total number of stems in the plot by the number of stems in the 1-square-inch area to determine the number of square inches.] For example, if a plot contains 1,000 stems of western wheatgrass (Agropyron smithii) and 20 stems have an area of one square inch, the area of this species on the plot is 50 square inches.

b. ***Annual Grasses.*** For annual grasses, use the same procedure used for rhizomatous grasses (see preceding section). Estimate, as nearly as possible, the basal cover of the plants and not the foliar cover.

I. Calculations

Calculate the trend index by totalling the following factors and recording them on the Trend Study Data - Photo Plot Method Form (see Illustration 60).

1. Composition

The composition factor is the percentage that the key species make up of the total plant composition on the plot.

2. Vegetation Cover

The vegetation cover factor is the percent ground cover provided by all live vegetation (basal cover of grasses plus foliar cover of forbs and shrubs) on the plot.

3. Seedlings

The seedlings factor is the total number of seedlings of the key species on the plot.

4. Litter

The litter factor is the percentage of the plot area that is covered by litter.

United States Department of the Interior
Bureau of Land Management
Study Location & Documentation Data

Page ____ of ____

Study Method				Study Number	
Allotment Name & Number			Pasture		
District		Resource Area			
Ecological Site		Plant Community			
Date Established	Established by (Name)		Map Reference		
Elevation	Slope	Exposure	Aerial Photo Reference		
Township	Range	Section	1/4	1/4	1/4
Location				Scale: ____ inches equals one mile	
Key Species 1 2 3					
Distance and bearing between reference post or reference point and the transect location stake, beginning of transect, or plot					
Distance and bearing between location stake and bearing stake					
Transect Bearing	Vertical Distance Between Ground & Aligned Tape				
Length of Transect	Plot/Frame Size				
Sampling Interval	Total Number of Samples				

Notes (Description of study location, diagram of transect/plot layout, description of photo points, etc. If more space is needed, use reverse side or another page.)

Note: Depending on the study method, fill in the blocks that apply when a study is established. This documentation enables the examiners to conduct follow-up studies in a consistant manner to provide comparable data for analysis, interpretation, and evaluation.

Page 1 of 1

United States Department of the Interior
Bureau of Land Management
Study Location & Documentation Data

Study Method: Daubenmire Trend	Study Number: 035-27W-08-03
Allotment Name & Number: Quaking Aspen - 11037	Pasture: Sheep Creek
District: Howe	Resource Area: Lost Mountain
Ecological Site: Clayey-15-19" Northern Plains	Plant Community: ARTR 2 - AGSP - PONE 3
Date Established: 7/24/84	Established by (Name): Charlie Wagon
Map Reference: Graystone 7½ min. topo.	
Elevation: 4300	Slope: Flat
Exposure: East	Aerial Photo Reference: BLM-24CN-A277A - 4/22/78

Location	Township	Range	Section	1/4	1/4	1/4
	3S	27W	8	NW	SE	NW

Scale: 2 inches equals one mile

Key Species				
1 AGSP 2 PONE 3 3		X		

Distance and bearing between reference post or reference point and the transect location stake, beginning of transect, or plot

The transect location stake is 100ft. south (180°) of the reference post. Reference post is 3 miles west of Redtop Reservoir.

Distance and bearing between location stake and bearing stake: 102 feet at 135°

Transect Bearing	Vertical Distance Between Ground & Aligned Tape: 3 inches
Length of Transect: 100 feet	Plot/Frame Size: 20x50 cm - 6 cover classes
Sampling Interval: Every 2ft. beginning at the 1-foot mark on the tape. Place the rear left corner of the frame at every 2nd foot mark along the right side of the tape.	Total Number of Samples: 50

Notes (Description of study location, diagram of transect/plot layout, description of photo points, etc. If more space is needed, use reverse side or another page.)

The two photo plots are located at 37 and 53 feet along the tape. Close-up photos are taken from the northeast side of the photo plots.

Note: Depending on the study method, fill in the blocks that apply when a study is established. This documentation enables the examiners to conduct follow-up studies in a consistant manner to provide comparable data for analysis, interpretation, and evaluation.

United States Department of the Interior
Bureau of Land Management
Trend Study Data
Photo Plot Method

Page ____ of ____

Study Number	Date	Examiner

Allotment Name & Number	Pasture

Part I—Plot data by square foot section

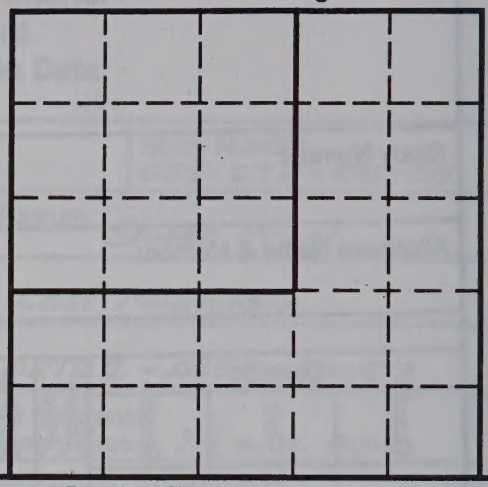
Species: Grass	Species: Forb	Species: Shrub	Mature Plants	Seedlings	1/16 Units	Total sq. inches	Mature Plants	Seedlings	1/16 Units	Total sq. inches	Mature Plants	Seedlings	1/16 Units	Total sq. inches	Mature Plants	Seedlings	1/16 Units	Total sq. inches	Mature Plants	Seedlings	1/16 Units	Total sq. inches
	(a)		(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)	(b)	(c)	(d)	(e)
	LITTER																					
	LITTER																					
	LITTER																					
	LITTER																					
	LITTER																					

Page ____ of ____

Part II—Summary of Plot Data

List by Species (a)	Number: Mature Plants (b)	Number: Seedlings (c)	1/16 Sq. Ft. Units (estimate) (d)	Total Sq. In. (measurement) (e)	Percent: Cover (f)	Percent: Composition (g)
Grasses (Basal Cover)						
Grass Totals						
Forbs (Foliar Cover)						
Forb Totals						
Shrubs (Foliar Cover)						
Shrub Totals						
Veg. Totals						
Litter						

Part III—Plot Diagram



Part IV—Trend Index Summary

Composition, Key Species *(percent)*	
Cover, Live Vegetation *(percent)*	
Seedlings, Key Species *(number)*	
Litter, Plot Total *(percent)*	
TOTAL	

Specific Instructions

(Items not listed are self-explanatory)

Part I—Plot Data by Square Foot Section

Record data for each 1' x 1' section of the plot

Column (a) - Use the standard plant code (Scientific Symbol). Indicate which species are the key species.
Column (b) & (c) - Enter number
Column (d) - *Estimate* - 1/16 sq. feet units covered by species.
Column (e) - *Measure* - Total sq. inches covered by species.
Note: Use *either* estimate or measurement for *each* species. Do *not* use both.
Total - Total data for *each* species and enter in Part II.

Part II—Summary of Plot Data

Column (f) - To convert measurement data to percent cover - $\frac{\text{Measured sq. inches (Column (e))}}{\text{1296 (3' x 3' plot) or 3600 (5' x 5' plot)}} \times 100 = \text{percent cover}$

- To convert estimate data to percent cover - Multiply Column (d) by 0.7 (3' x 3' plot) or 0.25 (5' x 5' plot) = percent cover

Column (g) - To calculate composition - $\frac{\text{\% Cover } \textit{(Column (f))} \text{ of each species}}{\text{Total \% vegetation cover } \textit{(of plot in Column (f))}} \times 100 = \text{percent composition}$

Page 1 of 2

United States Department of the Interior
Bureau of Land Management
Trend Study Data
Photo Plot Method

Study Number	Date	Examiner
345-02W-17-02	6/19/84	Al Zisk

Allotment Name & Number	Pasture
Black Butte - 1234	Butte

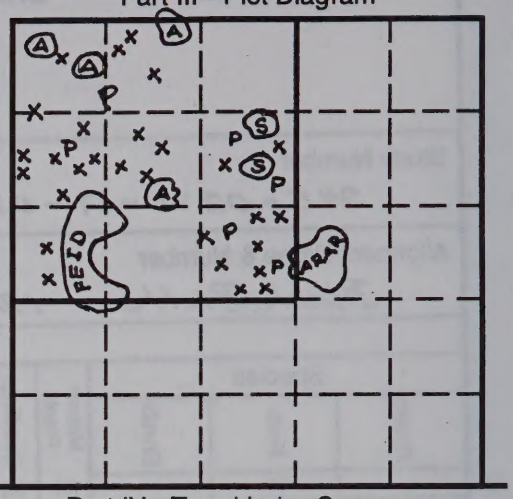
Part I—Plot data by square foot section

Species			Mature Plants (b)	Seedlings (c)	1/16 Units (d)	Total sq. inches (e)	Mature Plants (b)	Seedlings (c)	1/16 Units (d)	Total sq. inches (e)	Mature Plants (b)	Seedlings (c)	1/16 Units (d)	Total sq. inches (e)	Mature Plants (b)	Seedlings (c)	1/16 Units (d)	Total sq. inches (e)	Mature Plants (b)	Seedlings (c)	1/16 Units (d)	Total sq. inches (e)
Grass	Forb (a)	Shrub																				
AGSP – Key Species			2		.4		1		.4						← Angle Iron Stake							
POSE			2		.2		3		.5													
	PHHO		1		.1		–		.1													
	LITTER				4.3				.8				.1									
POSE			7		.6		4		.5		2		.3									
SIHY											2		.5				N					
FEID – Key Species			–		.2																	
	PHHO		1		.2						2		.4									
AGSP							1		.1													
	LITTER				.7				.1				.8									
POSE			2		.2		–		T		8		.8									
FEID			3		4.1		–	1	.4													
	PHHO										2		.6									
		ARARB									1		.1									
AGSP							–		T													
	LITTER				4.9				.3				.6									
			← Angle Iron Stake						Camera Point													
	LITTER																					
	LITTER																					

Part II—Summary of Plot Data

List by Species (a)	Number: Mature Plants (b)	Number: Seedlings (c)	1/16 Sq. Ft. Units (estimate) (d)	Total Sq. In. (measurement) (e)	Percent: Cover (f)	Percent: Composition (g)
Grasses (Basal Cover)						
AGSP (Key Sp.)	4		0.9		.63	8.4
POSE	28		3.1		2.17	29.0
SIHY	2		0.5		.35	4.7
FEID (Key Sp.)	3	1	4.7		3.29	43.9
Grass Totals	37	1	9.2		6.44	86.0
Forbs (Foliar Cover)						
PHHO	6		1.4		.98	13.1
Forb Totals	6		1.4		.98	13.1
Shrubs (Foliar Cover)						
ARAR8	1		0.1		.07	.9
Shrub Totals	1		0.1		.07	.9
Veg. Totals					7.49	100.0
Litter			12.6		8.82	

Part III—Plot Diagram



Part IV—Trend Index Summary

Composition, Key Species *(percent)*	52.3
Cover, Live Vegetation *(percent)*	7.49
Seedlings, Key Species *(number)*	1
Litter, Plot Total *(percent)*	8.82
TOTAL	69.61

P - PHHO
x - POSE
(S) - SIHY
(A) - AGSP
L - Angle Iron Stake

Specific Instructions

(Items not listed are self-explanatory)

Part I—Plot Data by Square Foot Section

Record data for each 1' x 1' section of the plot

Column (a) - Use the standard plant code (Scientific Symbol). Indicate which species are the key species.
Column (b) & (c) - Enter number
Column (d) - *Estimate* - 1/16 sq. feet units covered by species.
Column (e) - *Measure* - Total sq. inches covered by species.
Note: Use *either* estimate or measurement for *each* species. Do *not* use both.
Total - Total data for *each* species and enter in Part II.

Part II—Summary of Plot Data

Column (f) - To convert measurement data to percent cover - $\frac{\text{Measured sq. inches (Column (e))}}{\text{1296 (3' x 3' plot) or 3600 (5' x 5' plot)}} \times 100 = \text{percent cover}$

To convert estimate data to percent cover - Multiply Column (d) by 0.7 (3' x 3' plot) or 0.25 (5' x 5' plot) = percent cover

Column (g) - To calculate composition - $\frac{\text{\% Cover } \textit{(Column (f))} \text{ of each species}}{\text{Total \% vegetation cover } \textit{(of plot in Column (f))}} \times 100 = \text{percent composition}$

DATE _____

NO. _____

R.A. _____

ALLOT. _____

PAST. _____

Illustration 61, page 1

DATE 7/24/84

NO. 035-27W-08-03

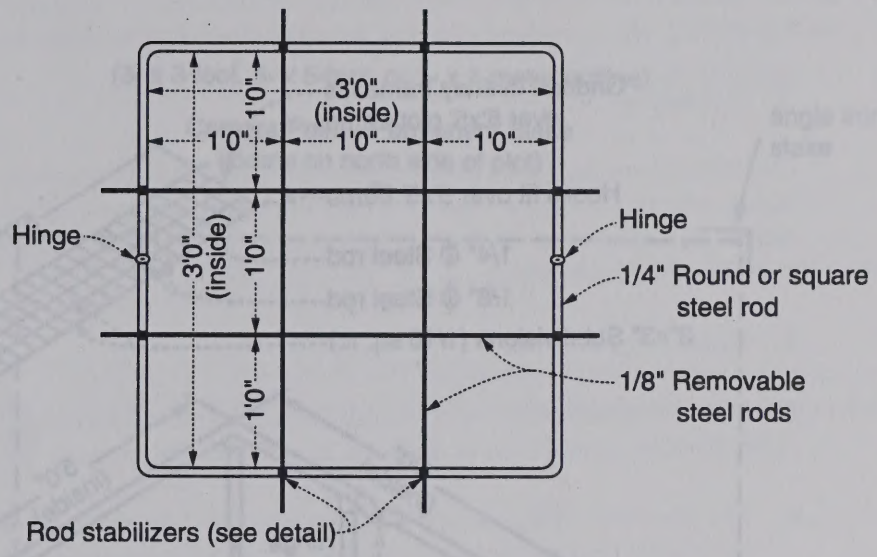
R.A. Lost Mountain

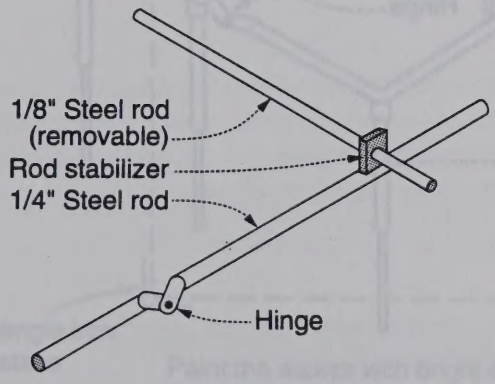
ALLOT. Quaking Aspen

PAST. Sheep Creek

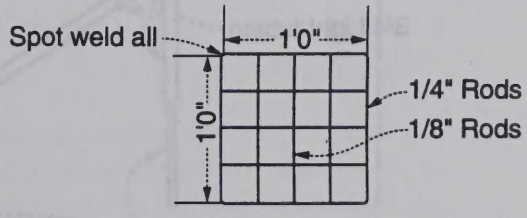
Rangeland Monitoring—Trend Studies

Photo Plot Frame - 3- x 3-foot





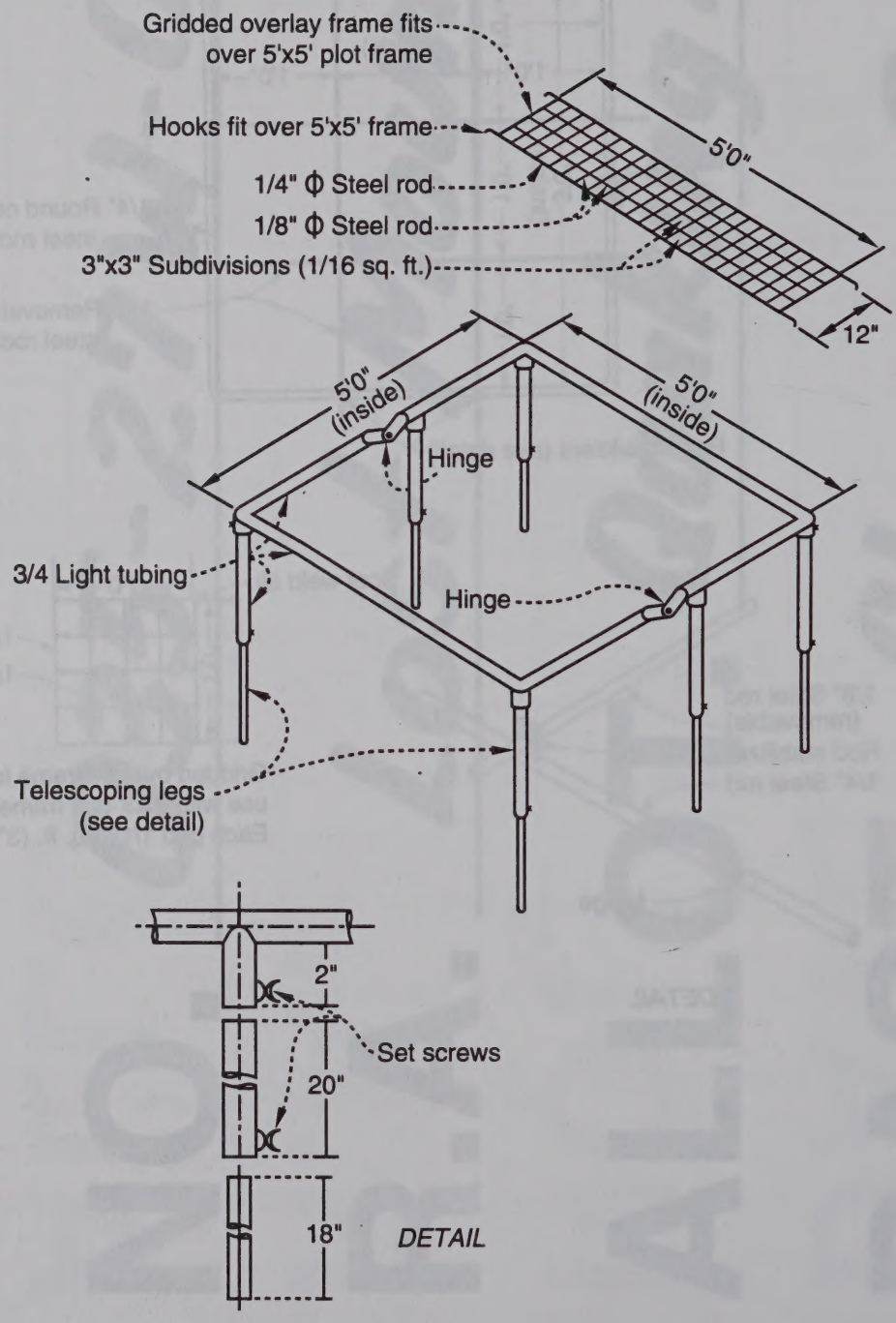
DETAIL



Gridded overlay frame for
use with 3'x3' plot frame.
Each grid 1/16 sq. ft. (3"x3")

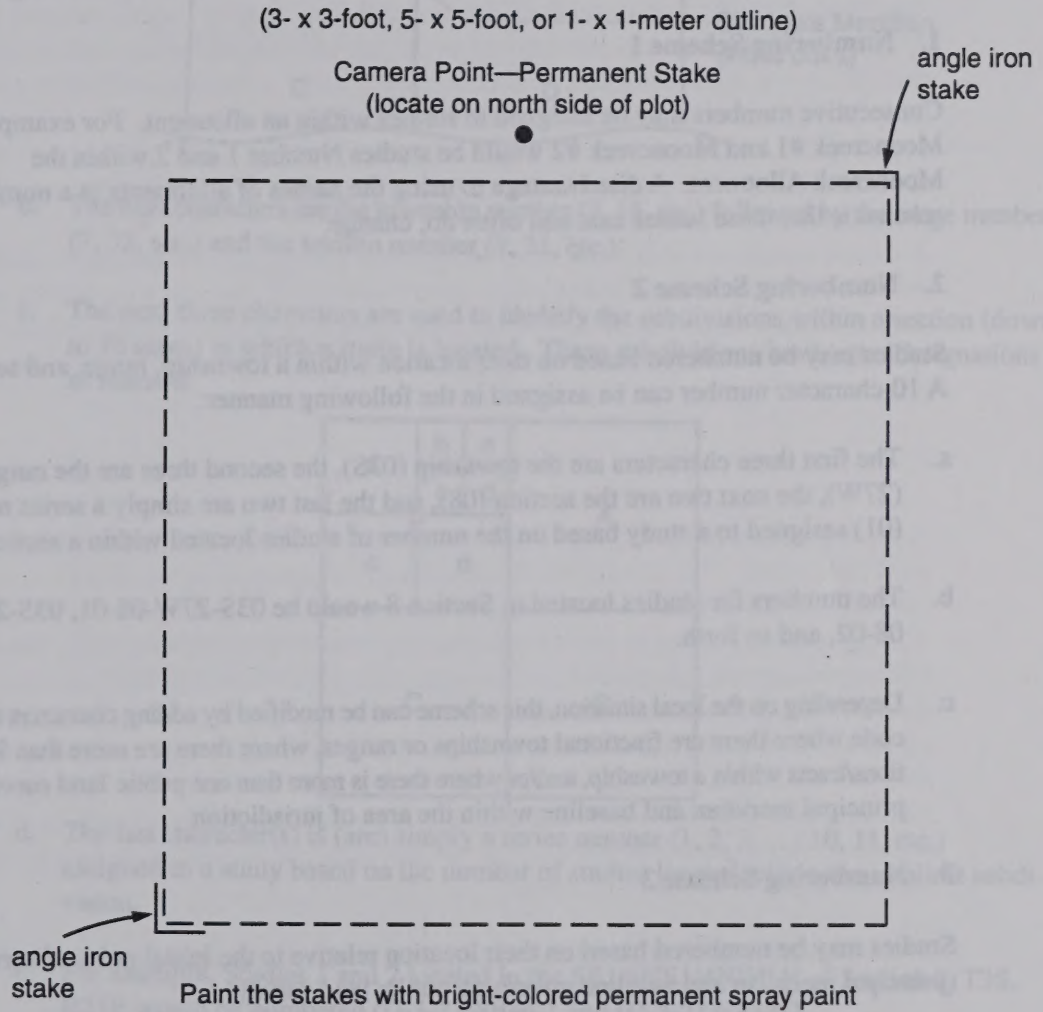
Rangeland Monitoring—Trend Studies

Photo Plot Frame—5- x 5-foot



Rangeland Monitoring

Permanent Photo Plot Location



Paint the stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent photographs are taken.

RANGELAND MONITORING/TREND STUDIES— STUDY AND PHOTOGRAPH IDENTIFICATION

A. Numbering Studies

Studies should be numbered to assure positive identification. These numbers can also be used to identify photographs. Following are three alternative schemes for numbering studies:

1. Numbering Scheme 1

Consecutive numbers may be assigned to studies within an allotment. For example, Mooncreek #1 and Mooncreek #2 would be studies Number 1 and 2 within the Mooncreek Allotment. A disadvantage to using the names of allotments in a numbering scheme is that these names can, and often do, change.

2. Numbering Scheme 2

Studies may be numbered based on their location within a township, range, and section. A 10-character number can be assigned in the following manner:

a. The first three characters are the township (03S), the second three are the range (27W), the next two are the section (08), and the last two are simply a series number (01) assigned to a study based on the number of studies located within a section.

b. The numbers for studies located in Section 8 would be 03S-27W-08-01, 03S-27W-08-02, and so forth.

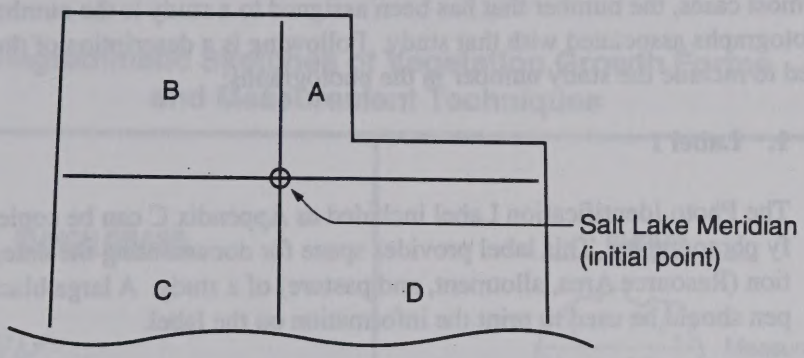
c. Depending on the local situation, this scheme can be modified by adding characters to the code where there are fractional townships or ranges, where there are more than 99 sections/tracts within a township, and/or where there is more than one public land survey principal meridian and baseline within the area of jurisdiction.

3. Numbering Scheme 3

Studies may be numbered based on their location relative to the initial point of survey (principal meridian and baseline governing public land survey).

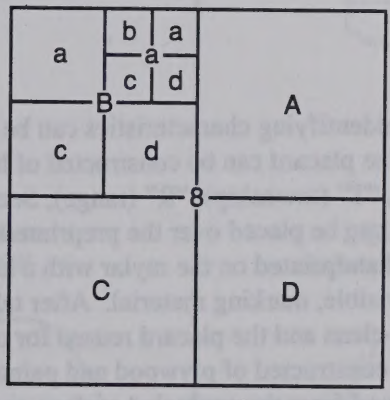
a. Under this scheme, the first character is a letter assigned to a principal meridian and baseline quadrant. Using the initial point of the survey as the center point, the northeast quadrant (townships located to the north and east of the initial point) is coded

"A". The northwest, southwest, and southeast quadrants are coded "B", "C", and "D", respectively. For example:



b. The next characters are the township number (3, 16, etc.) followed by the range number (7, 32, etc.) and the section number (8, 21, etc.).

c. The next three characters are used to identify the subdivisions within a section (down to 10 acres) in which a study is located. These subdivisions have letter designations as follows:



d. The last character(s) is (are) simply a series number (1, 2, 3, . . . 10, 11, etc.) assigned to a study based on the number of studies located within the smallest subdivision.

e. For example, Studies 1 and 2 located in the SE1/4NE1/4NW1/4 of Section 8, T3S, R21E would be numbered (D-3-21)8Bad-1 and (D-3-21)8Bad-2.

f. Depending on the local situation, this scheme can be modified by adding characters to the code where there are fractional townships or ranges, where there are more than 99 sections/tracts within a township, and/or where there is more than one public land survey principal meridian and baseline within the area of jurisdiction.

B. Identifying Photographs

In most cases, the number that has been assigned to a study is the number used to identify the photographs associated with that study. Following is a description of three labels that can be used to include the study number in the photographs:

1. Label 1

The Photo Identification Label included as Appendix C can be copied and used to identify photographs. This label provides space for documenting the date, number, and location (Resource Area, allotment, and pasture) of a study. A large black felt-tip marking pen should be used to print the information on the label.

2. Label 2

A slotted sign board with a black felt background and movable white plastic letters can be used as a photo identification label. Room permitting, the user may include any information desired on such a label. A 9- x 12-inch board with slots running lengthwise at a spacing of 1/4-inch and 1-1/2-inch white letters makes a highly visible label for most photographs.

3. Label 3

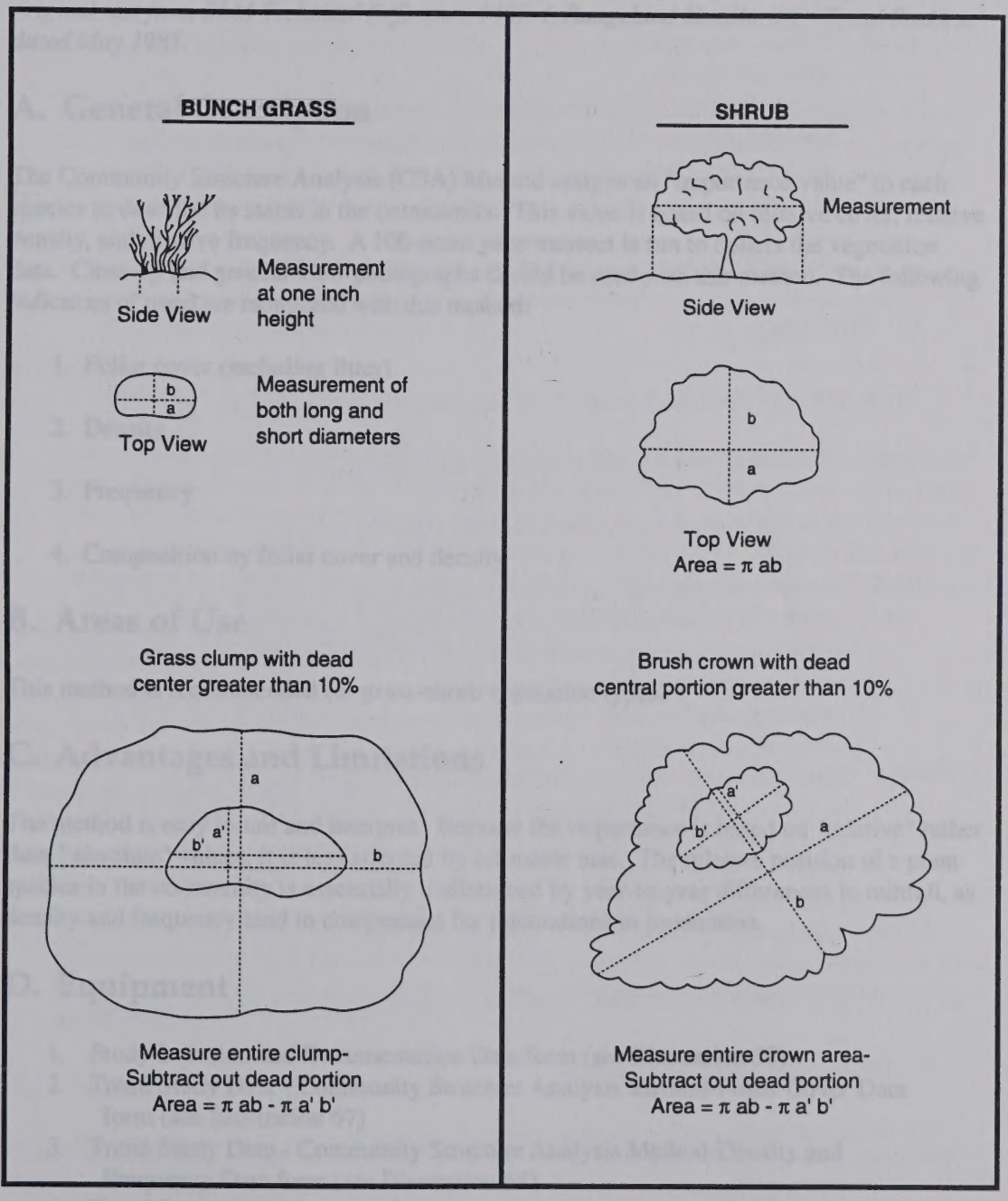
A placard on which identifying characteristics can be entered can be developed to meet local field needs. The placard can be constructed of heavy white cardboard on which such things as Date, "T" (township), "R" (range), Section Number, etc., are preprinted. A heavy mylar film can be placed over the preprinted placard. The specific identifying information can be handprinted on the mylar with a heavy grease pencil or other readily removable, highly visible, marking material. After taking the desired photographs, the mylar can be wiped clean and the placard reused for other photographs. A more permanent placard can be constructed of plywood and painted enamel white. The grease pencil markings can be wiped from the enameled surface and the placard reused for other photographs. Caution must be exercised in the placement of the placard to prevent glare from the mylar or enameled surface.

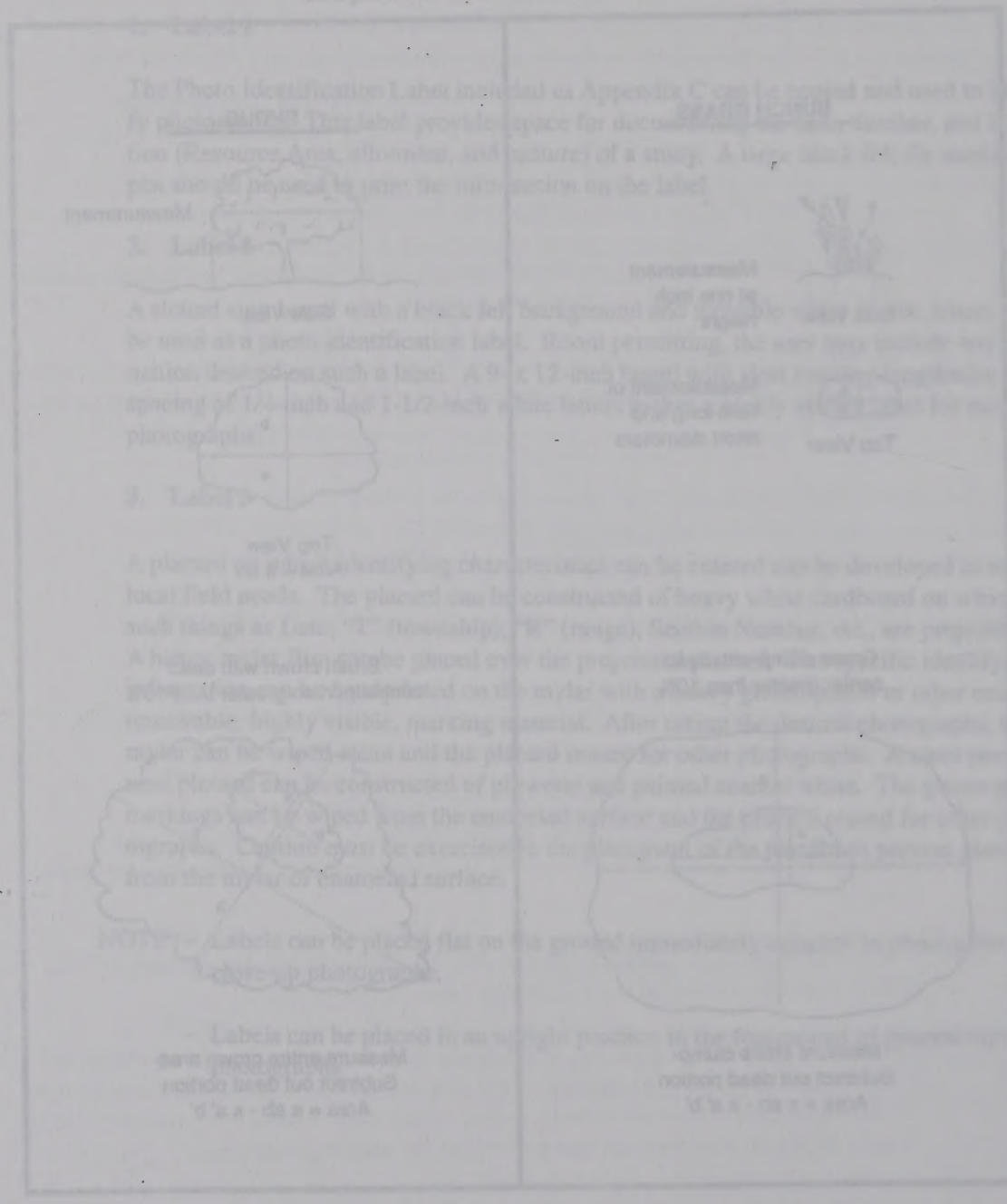
NOTE - Labels can be placed flat on the ground immediately adjacent to photo plots for close-up photographs.

- Labels can be placed in an upright position in the foreground of general view photographs.

Rangeland Monitoring—Trend Studies

Diagrammatic Sketches of Vegetation Growth Forms and Measurement Techniques





XVIII. COMMUNITY STRUCTURE ANALYSIS

Editor's Note: The Community Structure Analysis procedures were transcribed from the original text from BLM Technical Reference 4400-4, Rangeland Monitoring - Trend Studies, dated May 1985.

A. General Description

The Community Structure Analysis (CSA) Method assigns an "importance value" to each species to describe its status in the community. This value is based on relative cover, relative density, and relative frequency. A 100-point pace transect is run to collect the vegetation data. Close-up and general-view photographs should be used with this method. The following indicators of trend are monitored with this method:

1. Foliar cover (including litter)
2. Density
3. Frequency
4. Composition by foliar cover and density

B. Areas of Use

This method is recommended for grass-shrub vegetation types.

C. Advantages and Limitations

The method is easy to use and interpret. Because the importance is based on "relative" rather than " absolute" values, it is less affected by estimator bias. The relative position of a plant species in the community is essentially undisturbed by year-to-year differences in rainfall, as density and frequency tend to compensate for fluctuations in production.

D. Equipment

1. Study Location and Documentation Data form (see Illustration 59)
2. Trend Study Data - Community Structure Analysis Method-Foliar Cover Data form (see Illustration 67)
3. Trend Study Data - Community Structure Analysis Method-Density and Frequency Data form (see Illustration 68)
4. Trend Study Data - Community Structure Analysis Method-Summary form (see Illustration 69)
5. Photo Identification Label (see Illustration 61)

6. Frame to delineate the 3- x 3-foot photo plots
7. Stakes: 3/4- or 1-inch angle iron not less than 16 inches long
8. Hammer
9. Permanent yellow or orange spray paint
10. Camera: 35-mm with a 28-mm wide-angle lens
11. Exposure meter (if camera is not equipped with one)
12. Film
13. Tripod (optional)
14. Black felt-tip pen
15. Microplot frame: 5 x 10 centimeters divided into quarters
16. Circular plot frame: 9.6 square feet or smaller if vegetation is dense
17. Tally counter (optional)
18. Compass
19. Steel post
20. Post driver

E. Training

The accuracy of the data depends on the training and ability of the examiners.

1. Examiners must be able to identify the plant species.

2. Examiners must know how to collect foliar cover data.

3. Examiners should be consistent in determining the number of individual plants. For most plant species, individuals are readily distinguished. However, most communities contain some species that reproduce vegetatively. Determination of what constitutes a plant unit in such cases is somewhat arbitrary. For rhizomatous grasses such as western wheatgrass (Agropyron smithii), each culm group can be visualized as an actual or potential plant unit, as can rooted stoloniferous units of such species as vine mesquite (Panicum obtusum). Mat or sod-forming plants such as blue grama (Bouteloua gracilis) or alkali sacaton (Sporobolus airoides) usually start growth as small, distinct clumps but may spread to become plants that are a yard or more in diameter. As this occurs, they tend to fragment into more-or-less separate units, and it is these separate units that should be counted as actual or potential individuals.

4. Examiners must be familiar with the operation of the camera equipment.

F. Establishing Transects

Careful establishment of transacts is a critical element in obtaining meaningful data.

1. Site Selection

Stratify the allotment, wildlife habitat area, herd management area, watershed area, or other designated management area; select the key area(s) and key species; and determine the number, length, and location of the transacts.

2. Number of Transects

Establish one transect on each key area; establish more if needed.

3. Transect Layout

a. Drive an angle iron location stake into the ground to permanently mark the location of each transect (see Illustration 70).

b. At the location stake, determine the transect bearing and select a prominent distant landmark such as a peak, rocky point, etc., that can be used as the transect bearing point. Drive an angle iron stake into the ground at a point 6 feet from the location stake along the transect bearing (see Illustration 70).

c. Paint the transect location and transect bearing stakes with bright-colored permanent spray paint (yellow or orange) to aid in relocation. Repaint these stakes when subsequent readings are made.

4. Reference Post or Point

Permanently mark the location of each transect by means of a reference post (steel post) placed about 100 feet from the transect location stake. Record the bearing and distance from the post to the transect location stake. An alternative is to select a reference point, such as a prominent natural or physical feature, and record the bearing and distance from that point to the transect location stake. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study established by the Bureau of Land Management and that it should not be disturbed.

5. Transect Identification

Number transacts for proper identification to ensure that the data collected can be positively associated with specific sites on the ground (see Illustration 65).

6. Transect Documentation

Document the location, starting point, bearing, sampling interval, and other pertinent information concerning the transect on the Study Location and Documentation Data form (see Illustration 59). Plot the precise location of the transacts on detailed maps and/or aerial photos.

G. Taking Photographs

Take close-up photographs of the photo plot, as well as the general-view photographs, before making any measurements or estimates.

H. Sampling Process

The studies data are collected by species along a 100-point pace transect. Microplots are read at each point and a 9.6-square-foot, or other size, circular plot is read at each tenth microplot. Data are recorded on the Trend Study Data - Community Structure Analysis Method—Foliar Cover Data form and the Trend Study Data - Community Structure Analysis Method—Density and Frequency Data form (see Illustrations 67 and 68). When the transacts are reread, follow the same process that was used when they were established. In addition to collecting the specific studies data, general observations should be made of the study sites.

1. Collecting Cover Data

a. Beginning at one pace from the transect bearing stake along the transect bearing, collect cover data with a 5- x 10-cm microplot frame at every pace (every alternate step), or at some other prescribed interval, along the transect for a total of 100 samples (see Illustration 70). Center the microplot frame in front of the toe.

b. With each placement of the microplot frame, estimate the foliar coverage of each perennial plant species. Record the dot count tally for each species by cover class on the Trend Study Data - Community Structure Analysis Method—Foliar Cover Data form (see Illustration 67). Foliar coverage data may also be collected for annual plant species. The cover classes are as follows:

Cover Class	Range of Coverage	Midpoint of Range
1	1-5%	2.5%
2	5-25%	15.0%
3	25-50%	37.5%
4	50-75%	62.5%
5	75-95%	85.0%
6	95-100%	97.5%

c. Alternative cover classes can be used with this method. When transacts are reread, use the same cover classes used when the studies were established. An example of a ten-cover-class system is as follows:

Cover Class	Range of Coverage	Midpoint of Range
1	1-5%	2.5%
2	5-12.5%	8.75%
3	12.5-25%	18.75%
4	25-37.5%	31.25%
5	37.5-50%	43.75%
6	50-62.5%	56.25%
7	62.5-75%	68.75%
8	75-87.5%	81.25%
9	87.5-95%	91.25%
10	95-100%	97.5%

d. Estimate the undisturbed foliar cover for grasses, forbs, and shrubs. Consider all individuals of a plant species in the microplot as a unit. All other kinds of plants are ignored as each plant species is considered. The plants do not have to be rooted in the plot.

e. The 5- x 10-cm microplot frame is divided into fourths to assist in estimation.

f. Overlapping foliar cover is included in the cover estimates by species; therefore, total cover may exceed 100 percent. Total cover may not reflect actual ground cover.

g. Estimate and record the cover for litter (loose plant material or standing dead material) and rock (1/2 inch in diameter and larger).

2. Collecting Density and Frequency Data

a. At each tenth microplot, collect density data with a 9.6-square-foot circular plot (see Illustration 70). Center the circular plot frame in front of the toe. A total of ten samples is collected. Depending on the density of the vegetation, a smaller size circular plot may be used. Record the number of plants by species for all perennial grasses, forbs, and shrubs on the Trend Study Data - Community Structure Analysis Method—Density and Frequency Data form (see Illustration 68). Density and frequency data may also be collected for annual plant species.

b. Count by species all plants rooted within the plot. The majority of the base of the plant must be in the plot to be counted.

I. Calculations

1. Cover

Calculate the percent cover by species as follows:

a. Convert the dot count for each species in each cover class to the number of plots that included that species in that cover class.

b. Multiply this value times the midpoint of the appropriate cover class.

c. Total the products for all cover classes by species.

d. Divide the sum by the total number of microplots sampled on the transect (usually 100).

e. Record the percent cover by species on the Trend Study Data - Community Structure Analysis Method—Foliar Cover Data form and on the Trend Study Data - Community Structure Analysis Method—Summary form (see Illustrations 67 and 69).

2. Density

Calculate the density for each plant species by adding the number of plants of the species counted in the 10 circular plots. Record the totals on the Trend Study Data - Community Structure Analysis Method—Density and Frequency Data form and on the Trend Study Data - Community Structure Analysis Method—Summary form (see Illustrations 68 and 69).

3. Frequency

Calculate the percent frequency for each plant species by dividing the number of circular plots in which the species occurred by the total number of circular plots sampled (usually 10) and multiplying the value by 100. Record the percent frequency on the Trend Study Data - Community Structure Analysis Method—Density and Frequency Data form and on the Trend Study Data - Community Structure Analysis Method—Summary form (see Illustrations 68 and 69).

4. Importance Value

The importance value of a species is a composite score of the relative cover, relative density, and relative frequency; it represents the relative importance of that species in the plant community. Calculate the relative values by dividing the individual species values for cover, density, and frequency, by the total values for these data categories for all species. Plant species can be ranked by importance value. The total community has an importance value of 3.00. The importance value is calculated and recorded on the Trend Study Data - Community Structure Analysis Method—Summary form. The percent plant cover, litter cover, rock cover, and bare ground are also recorded on this form (see Illustration 69).

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Bureau of Land Management

Trend Study Data
Community Structure Analysis Method—Foliar Cover Data

Page ____ of ____

Study Number	Date	Examiner	Allotment Name & Number	Pasture

Cover Category and Plant Species	Cover Class 1 1-5 % (2.5)		Cover Class 2 5-25 % (15)		Cover Class 3 25-50 % (37.5)		Cover Class 4 50-75 % (62.5)		Cover Class 5 75-95 % (85)		Cover Class 6 95-100 % (97.5)		Percent Cover
	Dot Count	#	Dot Count	#	Dot Count	#	Dot Count	#	Dot Count	#	Dot Count	#	
Litter													
Rock ≥ 1/2 inch													

Percent Cover by Species $= \sum \left[\frac{\text{(no. in) (Midpoint)}}{\text{(Class 2) (Class 2)}} + \ldots + \frac{\text{(no. in) (Midpoint)}}{\text{(Class 2) (Class 2)}} \right]$

Notes (Use other side or another page)

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Trend Study Data
Community Structure Analysis Method—Foliar Cover Data

Page 1 of 1

Study Number	Date	Examiner	Allotment Name & Number	Pasture
CUBA #1	9/15/84	Joe Blue	CUBA – 2431	South

Cover Category and Plant Species	Cover Class 1 1-5 % (2.5)		Cover Class 2 5-25 % (15)		Cover Class 3 25-50 % (37.5)		Cover Class 4 50-75 % (62.5)		Cover Class 5 75-95 % (85)		Cover Class 6 95-100 % (97.5)		Percent Cover
	Dot Count	#	Dot Count	#	Dot Count	#	Dot Count	#	Dot Count	#	Dot Count	#	
Litter	⊠ ⊠ ⊡	28	⊠ ⊓	17	⁚	3							4
Rock ≥ 1/2 inch	⊠	9	⁚	2			•	1					1
HIJA	⊠ ⊡	18	⊠ ⊠ ⁚	23	⊠	10	⁚	2					9
SPAI	⊓	6	⁖	5									1
SIHY	⊠ ⊠ ⊓	26	⊓	7	⁚	3							3
BOGR 2	⊠ ⁚	12	⊠ ⊓	17	⁚	3	•	1					5
ASTRA	⁚	3	⊓	6	•	1							1
SPDI 3	•	1	⁖	4	⁚	2							1
EULA 5	⁖	5	⊠	9	•	1							2
GUSA 2	⊠	9	⁚	2	⁚	3							2
OPCL	⁚	2	⁚	3			•	1					1
ATOB	⁖	4	⊡	8	⁖	5			•	1			4
											(100 Samples)		

Percent Cover by Species $= \sum \left[\frac{(\text{no. in}) (\text{Midpoint})}{(\text{Class 2}) (\text{Class 2})} + \ldots + \frac{(\text{no. in}) (\text{Midpoint})}{(\text{Class 2}) (\text{Class 2})} \right]$

Notes (Use other side or another page)

Page ____ of ____

United States Department of the Interior
Bureau of Land Management
Trend Study Data
Community Structure Analysis Method—Density and Frequency Data

Study Number	Date	Examiner

Allotment Name & Number	Pasture

Plant Species	Plot Number										Density (Total)	Frequency (%)
	1	2	3	4	5	6	7	8	9	10		

Density = Total number of plants by species recorded for all ten plots.

Notes (Use other side or another page)

$$\text{Frequency (\%)} = \frac{\text{No. of plots in which a species occurs}}{10} \times 100$$

Page 1 of 1

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Bureau of Land Management
Trend Study Data
Community Structure Analysis Method—Density and Frequency Data

Study Number	Date	Examiner
CUBA #1	9/15/84	Joe Blue

Allotment Name & Number	Pasture
CUBA - 2431	South

Plant Species	Plot Number										Density (Total)	Frequency (%)
	1	2	3	4	5	6	7	8	9	10		
HIJA	4	3	-	7	2	5	7	-	2	6	36	80
SPAI	1	-	3	-	4	-	-	1	2	-	11	50
SIHY	-	2	4	1	3	2	5	-	-	3	20	70
BOGR2	3	2	5	2	4	4	-	-	3	4	27	80
ASTRA	-	1	-	-	-	-	-	1	-	-	2	20
SPDI3	1	-	-	1	-	1	-	-	1	-	4	40
EULA5	2	4	5	-	-	2	-	6	-	-	19	50
GUSA2	-	-	-	-	1	5	3	4	2	-	15	50
OPCL	-	1	-	-	1	-	-	-	-	-	2	20
ATOB	-	-	-	-	-	-	-	1	-	-	1	10

Density = Total number of plants by species recorded for all ten plots.

Notes (Use other side or another page)

Frequency (%) = $\frac{\text{No. of plots in which a species occurs}}{10} \times 100$

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Trend Study Data
Community Structure Analysis Method - Summary

Page ____ of ____

Study Number	Date	Examiner	Allotment Name & Number	Pasture

Plant Species	Foliar Cover		Density		Frequency		Importance Value
	%	(Relative)	Number	(Relative)	%	(Relative)	
		1.00		1.00		1.00	3.00

Plant Cover %	Litter %	Rock %	Bare Ground %

CALCULATIONS

1. **Plant Cover** - Total percent cover for all species listed on the Foliar Cover Data Form. (This value may be ≥ 100%.)
2. **Litter** - Total percent litter cover recorded on the Foliar Cover Data Form.
3. **Rock** - Total percent rock cover recorded on the Foliar Cover Data Form.
4. **Bare Ground** - 100 percent minus plant cover, litter, and rock percentages equals percent bare ground. (Note: Percent bare ground calculated in this manner will be much lower than it actually is because overlapping canopies as well as litter and rock beneath plant canopies are subtracted from 100%.)
5. **Plant Species** - List all the species listed on the Foliar Cover Data and Density and Frequency Data Forms.
6. **Foliar Cover**

   % — Enter the percent cover for each species listed on the Foliar Cover Data Form.

   Relative — Divide each species' % cover by the total plant cover. The relative cover column will total 1.00.

8. **Frequency**

   % — Enter the % frequency for each species listed on the Density and Frequency Data Form.

   Relative — Divide the % frequency for each species by the total frequency for all species. The relative frequency column will total 1.00.

9. **Importance Value** - Relative Cover + Relative Density + Relative Frequency = Importance Value by species. The importance value column will total 3.00.

Notes (Use other side or another page)

United States Department of the Interior
Bureau of Land Management

Trend Study Data
Community Structure Analysis Method - Summary

Study Number	Date	Examiner	Allotment Name & Number	Pasture
CUBA #1	9/15/84	Joe Blue	CUBA - 2431	South

Plant Species	Foliar Cover		Density		Frequency		Importance Value
	%	(Relative)	Number	(Relative)	%	(Relative)	
HIJA	9	.31	36	.26	80	.17	.74
SPAI	1	.03	11	.08	50	.11	.22
SIHY	3	.11	20	.15	70	.15	.41
BOGR 2	5	.18	27	.20	80	.17	.55
ASTRA	1	.03	2	.01	20	.04	.08
SPDI 3	1	.03	4	.03	40	.08	.14
EULA 5	2	.07	19	.14	50	.11	.32
GUSA 2	2	.07	15	.11	50	.11	.29
OPCL	1	.03	2	.01	20	.04	.08
ATOB	4	.14	1	.01	10	.02	.17
	29	1.00	137	1.00	470	1.00	3.00

Plant Cover	Litter	Rock	Bare Ground
29 %	4 %	1 %	66 %

CALCULATIONS

1. **Plant Cover** - Total percent cover for all species listed on the Foliar Cover Data Form. (This value may be ≥ 100%.)
2. **Litter** - Total percent litter cover recorded on the Foliar Cover Data Form.
3. **Rock** - Total percent rock cover recorded on the Foliar Cover Data Form.
4. **Bare Ground** - 100 percent minus plant cover, litter, and rock percentages equals percent bare ground. (Note: Percent bare ground calculated in this manner will be much lower than it actually is because overlapping canopies as well as litter and rock beneath plant canopies are subtracted from 100%.)
5. **Plant Species** - List all the species listed on the Foliar Cover Data and Density and Frequency Data Forms.
6. **Foliar Cover**

   % — Enter the percent cover for each species listed on the Foliar Cover Data Form.

   Relative — Divide each species' % cover by the total plant cover. The relative cover column will total 1.00.
8. **Frequency**

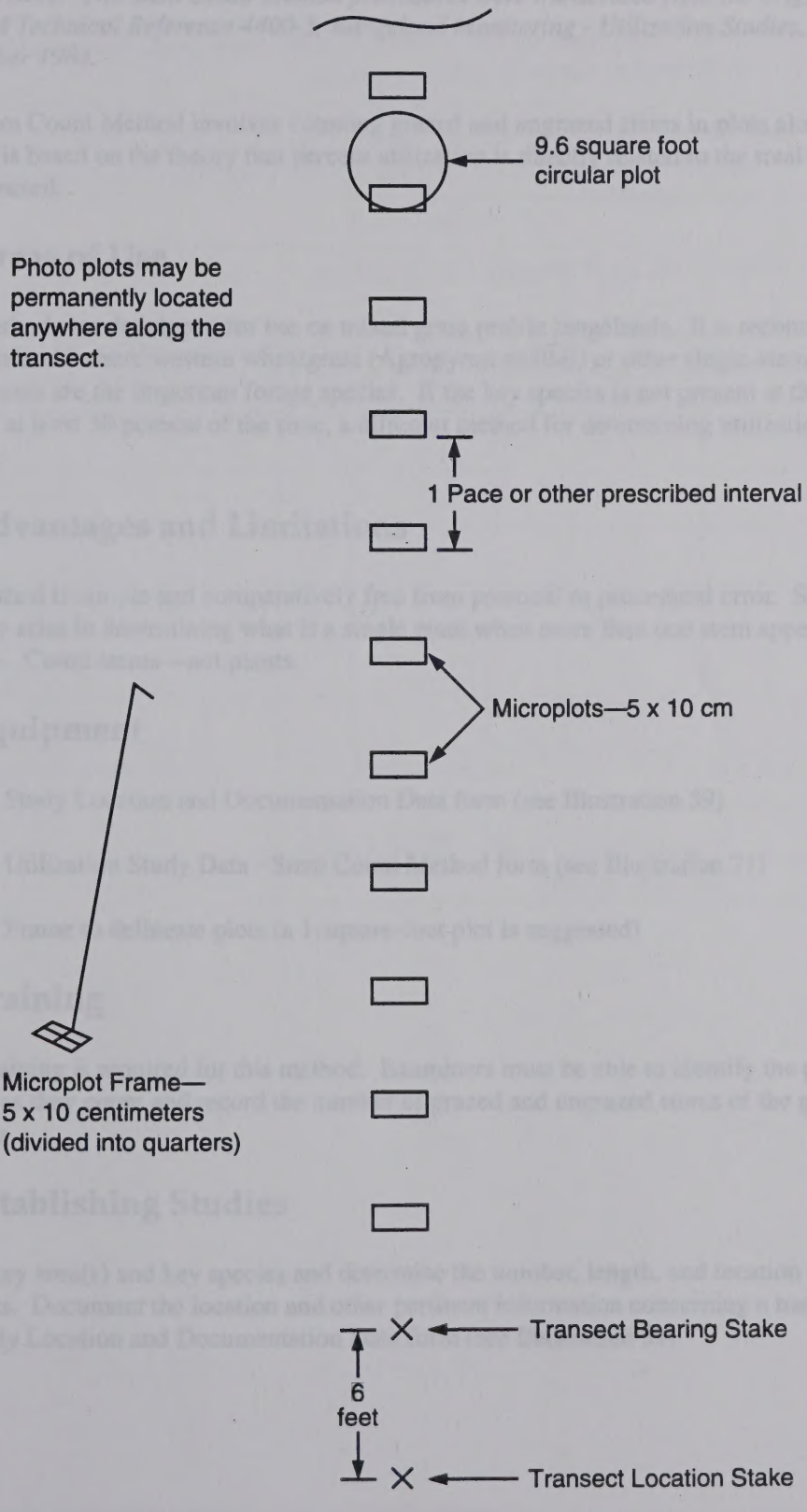
   % — Enter the % frequency for each species listed on the Density and Frequency Data Form.

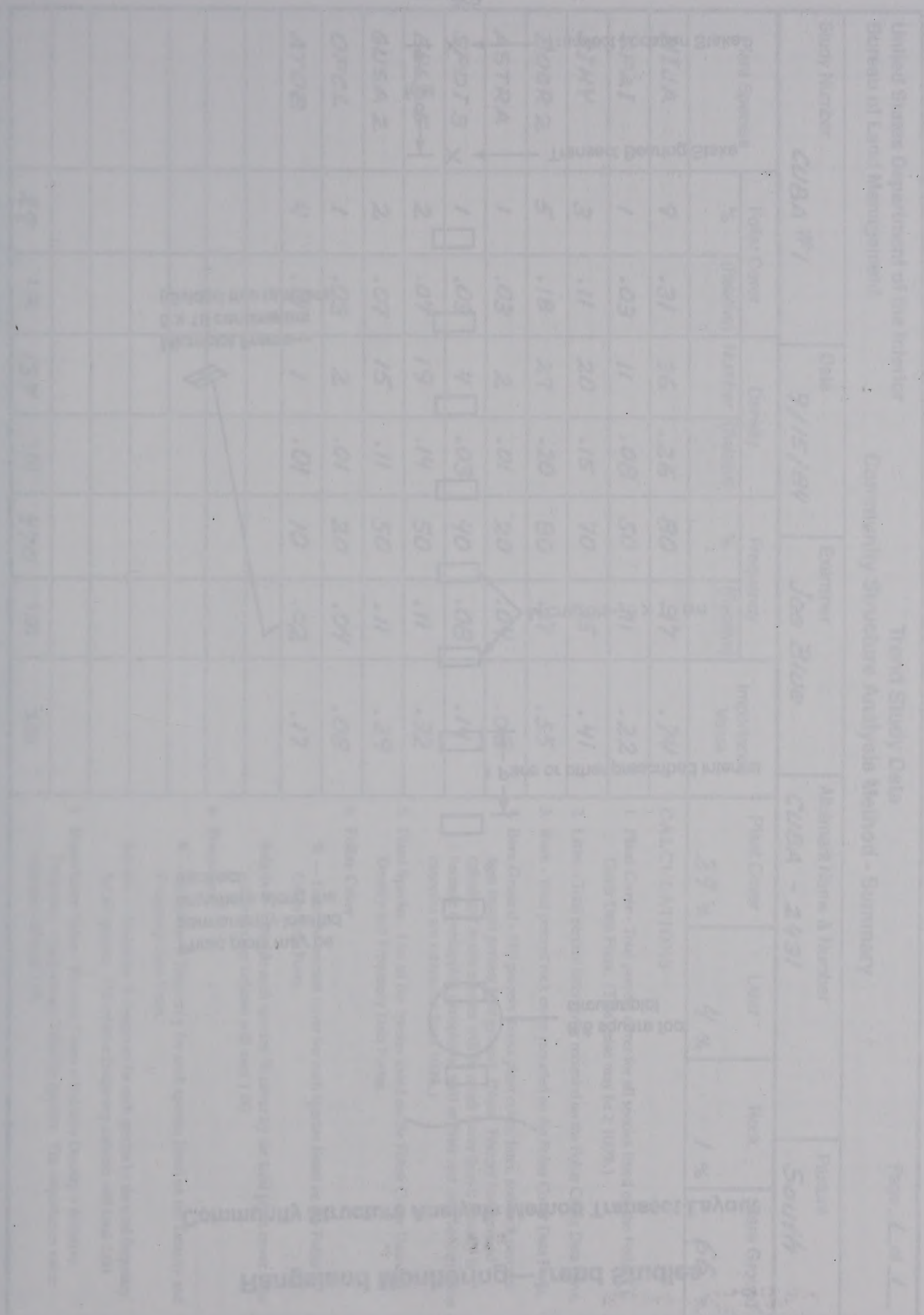
   Relative — Divide the % frequency for each species by the total frequency for all species. The relative frequency column will total 1.00.
9. **Importance Value** - Relative Cover + Relative Density + Relative Frequency = Importance Value by species. The importance value column will total 3.00.

Notes (Use other side or another page)

Rangeland Monitoring—Trend Studies

Community Structure Analysis Method Transect Layout





XIX. STEM COUNT METHOD

Editor's Note: The Stem Count Method procedures were transcribed from the original text in the BLM Technical Reference 4400-3, Rangeland Monitoring - Utilization Studies, dated September 1984.

The Stem Count Method involves counting grazed and ungrazed stems in plots along a transect. It is based on the theory that percent utilization is directly related to the total number of stems grazed.

A. Areas of Use

This method was developed for use on mixed grass prairie rangelands. It is recommended for rangelands where western wheatgrass (Agropyron smithii) or other single-stem rhizomatous grasses are the important forage species. If the key species is not present at the proper interval at least 50 percent of the time, a different method for determining utilization should be used.

B. Advantages and Limitations

The method is simple and comparatively free from personal or procedural error. Some problem may arise in determining what is a single plant when more than one stem appears from a rhizome. Count stems—not plants.

C. Equipment

1. Study Location and Documentation Data form (see Illustration 59)
2. Utilization Study Data - Stem Count Method form (see Illustration 71)
3. Frame to delineate plots (a 1-square-foot plot is suggested)

D. Training

Little training is required for this method. Examiners must be able to identify the plant species as they count and record the number of grazed and ungrazed stems of the grasses on the plots.

E. Establishing Studies

Select key area(s) and key species and determine the number, length, and location of the transacts. Document the location and other pertinent information concerning a transect on the Study Location and Documentation Data form (see Illustration 59).

F. Sampling Process

After examiners are trained, proceed with the collection of utilization data.

1. At each interval along the transect, place the frame immediately in front of the toe or on the nearest site having the key species.

2. Count all grazed and ungrazed stems of the key species in each plot and record the numbers separately on the Utilization Study Data Stem Count Method form (see Illustration 71).

G. Calculating Percent Utilization

Calculate the percent utilization (percent of stems grazed) by dividing the total number of grazed stems by the total number of stems (grazed plus ungrazed) and multiplying the result by 100. Record the percent utilization on the Utilization Study Data Stem Count Method form (see Illustration 71).

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United States Department of the Interior
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Utilization Study Data
Stem Count Method

Study Number	Date	Examiner

Allotment Name & Number	Pasture

Kind and/or Class of Animal	Period of Use

Key Species — Stem Count by Plot

Plot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Totals
Grazed																
Ungrazed																
Plot	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Totals
Grazed																
Ungrazed																
Plot	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	Totals
Grazed																
Ungrazed																

Notes (Use other side or another page if necessary)

Total GR Stems		Total GR + UNGR Stems	

$\frac{\text{Grazed Stems}}{\text{Total Stems}} \times 100 =$ % Utilization (Stems Grazed) ____ x 100

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United States Department of the Interior
Bureau of Land Management
Utilization Study Data
Stem Count Method

Study Number	Date	Examiner
13N-41E-27-04	9/30/84	Bob Jackstraw

Allotment Name & Number	Pasture
Blue Ridge - 0079	Chokecherry

Kind and/or Class of Animal	Period of Use
Horses	5/1 to 9/30

Key Species AGSM — Stem Count by Plot

Plot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Totals
Grazed	5	6	4	7	8	5	6	2	5	3	3	4	9	9	6	82
Ungrazed	3	8	9	0	6	10	8	9	5	6	8	1	5	3	2	83
Plot	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Totals
Grazed	5	8	7	9	6	8	5	9	9	7	7	4	5	7	4	100
Ungrazed	9	3	2	5	2	3	3	0	0	6	2	0	1	2	1	39
Plot	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	Totals
Grazed	5	2	3	7	7	5	7	4	6	10	4	5	3	6	2	76
Ungrazed	5	9	8	0	2	9	2	9	1	1	1	10	6	2	9	74

Notes (Use other side or another page if necessary)

Total GR Stems	258	Total GR + UNGR Stems	454

$\frac{\text{Grazed Stems}}{\text{Total Stems}} \times 100 = \text{\% Utilization (Stems Grazed)}$ $\quad \frac{258}{454} \times 100 = 57\%$

These horses have trampled the area around the undeveloped chokecherry spring until it is nothing but a mud hole. The spring head should be fenced and the water piped to a trough.

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United States Department of the Interior
Bureau of Land Management
Utilization Study Data
Stem Count Method

Study Number	Date	Examiner
13N-91E-27-09	9/30/91	Bob Hutchinson

Allotment Name & Number	Pasture
Blue Ridge - 0079	Chokecherry

Kind (Other Class of Animal)	Period of Use
Horses	6/1 to 9/30

Key Species AGSM

Stem Counts by Plot

Plot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Totals
Grazed	5	6	4	7	8	5	6	4	5	3	3	4	9	9	6	85
Ungrazed	3	8	7	0	6	10	8	9	5	6	10	1	5	3	2	93
Plot	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Totals
Grazed	5	8	7	9	6	8	5	9	9	7	7	4	5	7	7	103
Ungrazed	9	3	2	5	2	3	3	0	0	6	3	0	1	2	1	39
Plot	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	Totals
Grazed	5	2	3	7	7	5	7	4	6	10	9	5	3	6	2	82
Ungrazed	5	9	8	0	2	9	2	9	1	1	1	10	6	2	9	74

Notes: (Use other side or another page if necessary)

Total GP Stems	258	Total GP + UGP Stems	454
Grazed Stems / Total Stems x 100 = % Utilization (Stems Grazed)	258 / 454 x 100 =	57 %	

These horses have trampled the area around the unfenced chokecherry spring until it is nothing but a mud hole. The spring head should be fenced and the water piped to a trough.